Analysing supply chain strategies in healthcare from patient flow perspective: A systematic literature review

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Abstract

The paper aims to focus on systematically analysing and synthesising the extant research published on supply chain strategies (SCS) in healthcare. More specifically, the authors aim to answer three questions: "Q1 – What are the strategic intent of SCS?", "Q2 – What are the operational measurement?" and "Q3 – What are the inhibitors factors of SCS?" Furthermore, the paper strives to address the question of how SCS can help in redesigning an efficient patients' flow in response to face hospitals dual challenges of reducing cost whilst building the capability to accommodate growing numbers of patients with different and increasingly complex needs

Keywords: healthcare, patient flow, (Hybrid, Lean, and Agile) supply chain.

Introduction:
In response to healthcare system challenges, where limited resources are the main characteristics of the public healthcare on a global scale (Ix, 2009), redesigning of healthcare systems to deliver efficiency alongside quality care has become a demand of healthcare leaders, if not the public itself.

There has been a great deal of literature is available on supply chain management in manufacturing sector; however, little research exists on managing services especially healthcare services (Cherian et al. 2010). In healthcare, supply chain management processes have three types of flow: physical product flow, information flow and financial flow (Singh *et al.*, 2006). In this paper, the discussed supply chains are the patients (physical product) flow through the healthcare system, such a hospital. Addressing the question of how supply chain management can help in redesign an efficient patients' flow in healthcare organization.

This paper aims to focus on systematically analysing and synthesising the extant research published on supply chain strategies in healthcare. More specifically, the authors presented categorization of these strategies in healthcare that considers types of supply chain strategies, the strategic intents, operational measures and inhibiting factors of each strategy implementation. Furthermore, the paper strives to address the question of how supply chain strategy can help in redesigning an efficient patients flow in response to hospitals dual challenges of reducing cost whilst building the capability to accommodate growing numbers of patients with different and increasingly complex needs.

Methodology
This paper adopts a systematic or evidence-based literature review methodology based on the five-step approach developed by Tranfield et al. (2003) and Denyer and Tranfield (2009) as show in Figure 1. The advantages of the systematic literature review (SLR) approach over narrative reviews is that choices made during the literature search, selection, and analysis are reflected on and made explicit to result in a transparent and reproducible repository of knowledge.

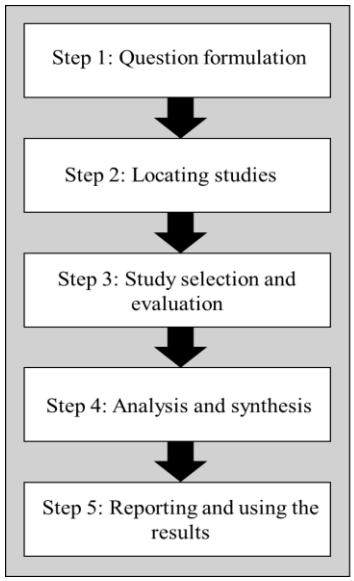

Figure 1: Five-step SLR process (adapted from Denyer & Tranfield, 2009).

Taking heed of advice for the conduct of structured reviews, Rousseau et al. (2008) guidance on study selection criteria in management and organizational sciences has been followed. Furthermore, as Durach et al. (2017) calls for a 'theoretical lens on the phenomenon of interest' to provide greater focus during the review, this study has chosen to look at patient flows from a supply chain strategy angle which fits with the research motivation as outlined in the introduction section.

To select relevant publications for review, firstly duplicates among the 11919 publications identified in the previous step were removed, which resulted in 10609 publications taken forward. Next titles and abstracts of the remaining publications were screened using a set of inclusion and exclusion criteria, which are shown in Table 1 below together with accompanying rationales for each criteria. To ensure the reliability of this process and prevent researcher bias, each of the authors independently reviewed a sample of 80 random abstracts with inclusion and exclusion choices subsequently discussed collaboratively between the three authors. This ensured that the criteria were understood and applied similarly. Subsequently the selection process based on titles and abstracts was undertaken by the first author while being consulted in borderline cases. This resulted in 10053 publications being removed from the pool.

Table 1: Inclusion and exclusion criteria applied during publication selection.

	Selection criteria	**Rationale**
Inclusion		
Year	Publications after 1999.	Naylor et al. (1999) & Mason-Jones & Towill (1999) were the first to define the leagility/ hybrid SC concept.
Source type	Academic journals, monographs, chapters of edited books, conference proceedings, working papers, professional publications, reports.	A wide range of sources were considered to ensure that all related and applicable published works were included. While not all of these sources can be expected to feature the same academic rigour as peer-reviewed journal articles, they may still provide useful knowledge and/ or current knowledge on a field that has received limited attention to date (compare Masi et al., 2017).
Scientific field	Healthcare industry, supply chain management, managing hospitals, health service quality and healthcare management.	These scientific fields are closely related to the topic of interest.
Exclusion		
Language	English language journals.	This is due to limited language capabilities of the authors.
Healthcare operations focus	Manufacturing-like level (pharmacy, radiology, laundry, etc...), Managerial and support (IT, finance, etc...) and Organisational level (design a strategy)	The objective of the research is the highlight the service issues in healthecare system (patient flow) not the logistic processes.
Journal quality	Publications in non peer-reviewed journals.	While non peer-reviewed knowledge is necessary to draw on in this immature field, particularly in the form of conference proceedings that report current developments in practice faster than journals may, it was chosen to exclude publications from non peer-reviewed journals on quality grounds.

Following these publication selection steps ultimately resulted in 58 publications to be selected in this review. Figure 2 below provides an overview of the different steps and how many publications were rejected or taken forward at each stage.

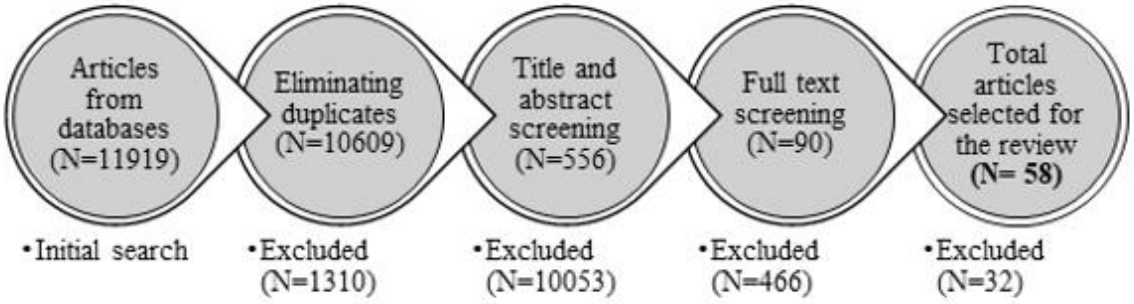

Figure 2: Summary of the publication selection process

Descriptive Analysis

It becomes apparent that research activity on supply chain management in healthcare has increased relatively steadily from 2010 onward, look at figure 3, with sparse publications prior to that year, before peaking in 2016. Given the cut-off point for the literature search in January of 2019, also shows that case studies remains the dominant research methodology in this area as 34 out of 58 publications use either a single or multiple case study approach.

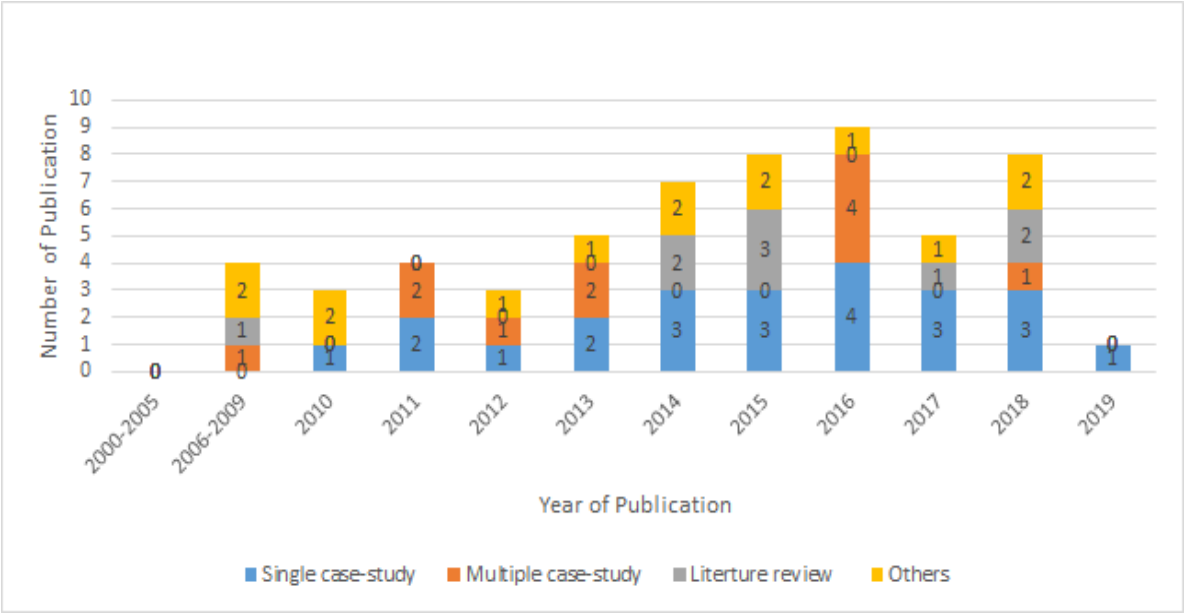

Figure 3: Number of publications and their respective methodologies across years

This strong base of qualitative empirical work is juxtaposed with a smaller number of studies using a variety of quantitative approaches.

In respect to the disciplines of research field, the findings illustrated in figure 4, where the field of supply chain strategy is still immature and requires further academic investigations.

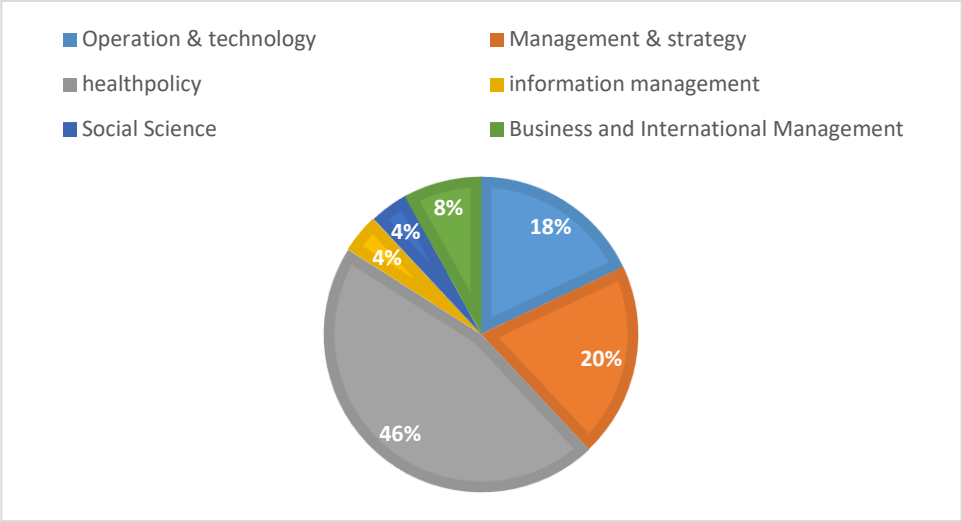

Figure 4: Publication distribution regarding disciplines of research field

Considering the geographical location of the first authors' institutions, a strong interest in SCM in healthcare appers to originate from the UK as being home institutions TO 39% of publications' first authors. Northen Europe and the Netherlands share their second place by accounting for 22% of publications each. A common trait among these countries may be their strong research base combined with the circumstance that healthcare has been conceived as a public rather than private good, which could ease data accessibility. The USA follows this field at (12%) of publications, with Italy accounting for (8%) and then other countries at (4%) or less, with eight countries being the origin of a single publication each.

Lastly, Figure 5 shows that 58 publications can be classified as either analysing a lean, agile, or hybrid supply chain strategy in their respective contexts.This imbalance suggests that academia has progressed further in the area of lean healthcare provision, which may be explained by the implementation of lean initiatives in healthcare before the backdrop of mounting cost pressures put on public healthcare in European countries with aging populations especially.

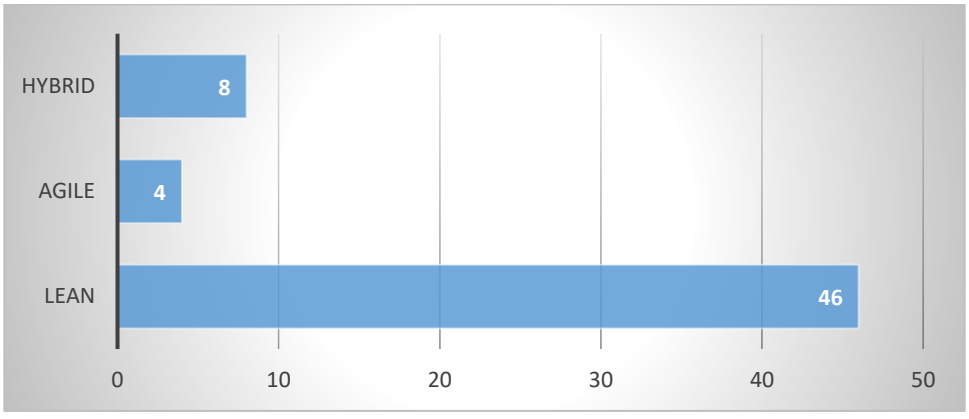

Figure 5: Number of publications adopting different supply chain strategy lenses in their healtcare contexts

Thematic Analysis

Having analysed the publications descriptively, this section will report the thematic findings.

Strategic intentions of lean, agile and hybrid supply chain approaches and operational measures:
Selected publications were divided into three themes based on their adopted or analysed supply chain strategy, which were lean, agile, and hybrid.

Five strategic intents for adopting either of the strategies were synthesized from the literature, which are a) improvement in patient care, b) elimination of waste, c) improvement in hospital performance, d) improvement in employee satisfaction, and e) increased responsiveness and flexibility. While there is overlap in some areas, these five intents represent the diversity of expectations researchers and practitioners hold for lean, agile, and hybrid supply chain strategies when attempting implementation.

An initial intent is the *improvement of patient outcomes*. Operationally this is typically measured by looking at how fast and with which level of safety patients move through the healthcare environment, although there are also authors that look at patient's overall quality of care (Crema & Verbano, 2016; Lillrank, et al., 2011; D'Andreamatteo ,2015). Another identified strategic intent relates to the *elimination of waste* – here three different perspectives emerged in the literature despite a conceptual overlap between the two in the understanding of lean strategies. One operational indicator that has been used as a proxy for the purpose of waste elimination are process times (e.g. Kollberg *et al.*, 2006; Manos, *et al.,* 2006; Souza, 2009; Hwang, *et al.,* 2014; Kreindler, 2017). The second understanding of waste refers to the issue of costs; (compare Radnor and Holweg, 2012; Hwang *et al.*, 2014; Roemeling *et al.*, 2017). The third intent is *improving hospital performance*, which is measured via a variety of indicators reflecting the diverse and conflicting goals endemic to the healthcare context, of initial interest here are hopes for increases in hospital productivity as measured through its efficiency – (Jorma *et al.* ,2016; Rahimnia and Moghadasian, 2010; Olsson and Aronsson, 2015). The fourth construct in *improving the satisfaction of healthcare professionals* is named by fewer authors than the previous three but can be expected to contribute to performance indirectly (Simons *et al.*, 2017 & Rees and Gauld, 2017). These initial four constructs that were identified feature heavily in the literature on lean supply chain strategy in healthcare. It appears that the terminology and purpose of the lean approaches with a focus on speeding up processes while striving to maintain quality has been directly adopted from other industries' successes of lean supply chain strategy. The fifth construct was only identified in papers on agile and hybrid supply chain strategies and aims to *increase responsiveness and flexibility*. (compare Rechel *et al.*, 2010; Aronsson *et al*., 2011; Converso *et al.*, 2015).

The inhibiting factors of lean, agile and hybrid adoption in healthcare:
Three problem area for adopting either of the strategies were highlighted from the literature, which are a) context-related, b) strategy-related, and c) human-related. These three restraining components represent the diversity of expectations researchers and practitioners hold for lean, agile, and hybrid supply chain strategies when attempting implementation. The existence of challenges in the healthcare setting may explain the slower adoption of either of supply chain strategies.

The first identified problem area while implementing a supply chain strategy is *context-related,* in other word, it is the area that considers the circumstances that form the setting for healthcare. (Lillrank et al, 2011; Drupsteen *et al*., 2013; Aronsson *et al*., 2011; Converso *et al.,* 2015; Kreindler, 2017).The second problem area is *strategy-related,* many literature have demonstrated that ambiguous strategy for employees is one of the major inhibiting factor can face the implementation of the adopted strategy many literature (Rechel *et al.*, 2010; D'Andreamatteo *et al.*, 2015; Roemeling, Land and Ahaus, 2017), the second perspective is a debatable definition of waste in service sector, (see e.g.

Grove *et al.*, 2010; Radnor and Holweg, 2012; Ahmed, Abd Manaf and Islam, 2018). The third problem area is *human-related*, four observed issues in this area are to be discussed. Firstly, the lack of leadership and communication (see more Grove *et al.*, 2010; Al-Hyari *et al.*, 2016; Dobrzykowski *et al.*, 2016). A second challenge facing lean application in hospitals is the lack of employee engagement and training (see e.g. Meijboom *et al.* , 2011; van Rossum *et al.*, 2016; Schonberger, 2018). The third challenge is organisational culture resistant to change, Kollberg *et al.*, (2006) specifically human- related issue regarding the embedding of change and blame culture are quite prevalent across healthcare sector which prevents lean strategy from being utilized in a systematic manner (compare Timmons *et al.* , 2014; Lot *et al.*, 2018).

The following in figure 6 is a summary of thematic findings represented in an archetype of supply chain strategies is healthcare context.

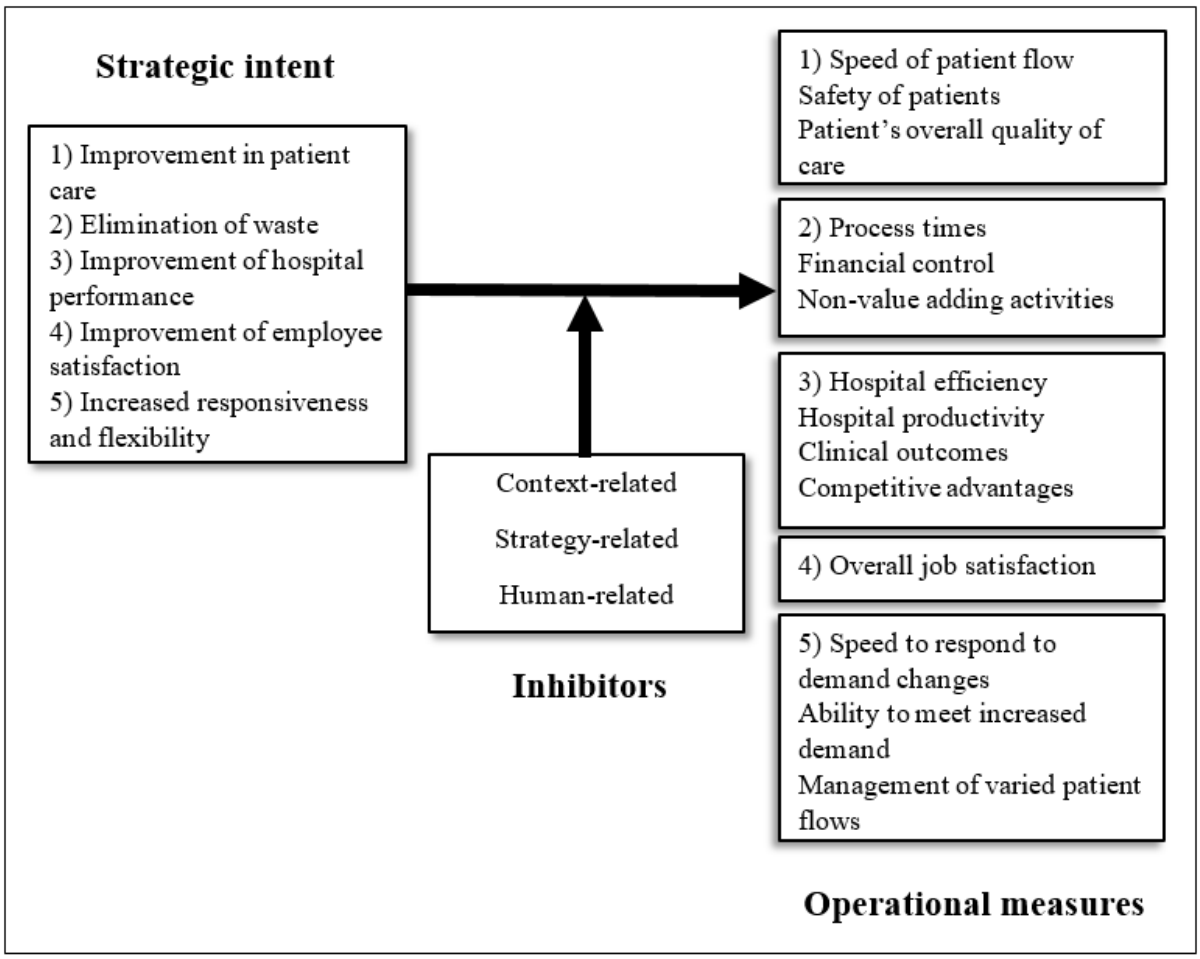

Figure 6: Archetype of supply chain strategies in healthcare

Conclusion:

By conducting SLR a holistic view is presented beyond reviewing individual papers, we will contribute to both the academic and professional communities. For researchers, the synthesised architype introduced is a further step in developing the understanding relating to the role of supply chain strategies in managing healthcare processes in the lens of patients flow. In the literature, lean supply chain implementation in healthcare has been discussed extensively while both agile and hybrid thinking have received little academic attention. Further research is needed to empirically test the implementation of hybrid

supply chain in healthcare, moreover, research assessing the properness of each strategy for managing patients flow is recommended which indicate the shift from the use of lean strategy as a topic of research to use agile as well as the combination of the two (i.e. hybrid).

For professionals, we will provide some managerial guidelines regarding the impact of supply chain strategies practices which should be of particular interest to hospitals' managers, in order to tackle hospitals' dilemma and how they can create and sustain competitive advantages in a complex and turbulent healthcare setting in addition to advice on how they can be implemented. The inhibitors factors can be used as a checklist to overcome the complexity of the hospital processes and to identify the appropriate strategy for improving performance regarding patients flow.

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